ORIGINAL ARTICLE

Incidence of congenital heart disease among neonates in a neonatal unit of a tertiary care hospital

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Abstract

Objectives: To determine the incidence and pattern of various congenital heart disease in a neonatal unit of a tertiary care hospital.

Methods: The prospective study was carried out in the neonatal unit of Combined Military Hospital, Rawalpindi, from September 2008 to August 2011. All 5800 neonates admitted with gestational age of >28 weeks irrespective of birthweight were included in the study. Neonatologist/Paediatrician carried out the neonatal examination during the first 12 hours of life. Neonates suspected of having congenital heart disease were further evaluated by pulse oxymetry, X-ray chest and echocardiography to ascertain final diagnosis and type of lesion. Data was collected on a predesigned proforma containing information regarding gender, mode of delivery, gestational age, weight at birth, family history, and associated malformations. SPSS 16 was used for statistical analysis.

Results: Of the 5800 neonates, 87 (1.5%) were found to have congenital heart disease with an incidence of 15/1000. There was a male preponderance. Most common lesion was ventricular septal defect 27(31.3%), followed by atrial septal defect 20 (22.9%), patent ductus arteriosus 13 (14.94%), tetralogy of fallot 06 (6.89%), transposition of great arteries 04 (4.59%), Pulmonary stenosis 05 (5.79%) and 03(3.44%) had atrioventricular canal defects.

Conclusion: Congenital heart disease is a common congenital anomaly. Its incidence varies from centre to centre due to different factors like nature of the sample, method of detection and early examination by a neonatologist/paediatrician. In this study a higher incidence is reported because it was carried out in a tertiary care unit, which is a referral hospital and all the neonates admitted in the unit were included in the study

Keywords: Neonates, Congenital heart disease, Incidence, Pakistan. (JPMA 64: 175; 2014)

Introduction

Congenital heart disease (CHD) is one of the most frequently occurring congenital defects which affect the newborn population.[1,2] CHD by definition as proposed by Mitchell[3] is "a gross structural abnormality of heart or intra-thoracic great vessels that is actually or potentially of functional significance". It has vast array of clinical presentation ranging from asymptomatic detection of the defects to symptomatic cardiac disease which may lead to death.[4] A congenital heart defect that requires surgery or catheter intervention in the first year of life is termed critical CHD and comprises about 25% of those suffering from CHD.[5]

In Pakistan about 40,000 children are born with a congenital heart defect annually.[4] Incidence was found to be 8.2/1000 live births in a study in China,[1] 25/1000 live births in Bangladesh,[6] and 8.1/1000 live births in a study in Atlanta.[7]

CHD has a multi-factorial etiology. Genetic and environmental factors play a part in the development.[8] Early CHD detection has a definite effect on prognosis and the future implications of the disease on the patient and the family.[4]

Scanty data is available on the incidence of CHD in neonates in our country and that is why we conducted this study. The aim was to estimate the incidence of CHD, the pattern of the malformations, and to compare our data with other national and international data on the issue.

Patients and Materials

The prospective study was conducted in the neonatal unit of Combined Military Hospital (CMH), Rawalpindi, from September 2008 to August 2011. It is a tertiary care referral hospital catering to patients from peripheral military hospitals as well as serious civilian patients. All the newborn babies of this hospital admitted in the neonatal unit for any reason from the operation theatre, labour rooms and post-natal wards were included in the study. Moreover, neonates admitted from outdoor and referred from other armed forces hospitals/civil hospitals were also included. Data was collected on a predesigned proforma that included information regarding gender, weight, gestational age, family history of CHD and associated

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malformations. Written consent of parents was taken. The study was regardless of gender, ethnicity, geographical distribution and weight. Cut-off gestational age was 28 weeks. Neonatologist/paediatrician carried out initial examination at least once during the first 12 hours of life. Second neonatal examination was done after 24 hours of life before discharge from hospital. Suspicion of CHD was based on following findings as proposed by Mitchell et all[3] a cardiac murmur; cyanosis or feeding difficulty only; cyanosis associated with feeding difficulty; features of congestive cardiac failure. Suspected cases of CHD were further evaluated by pulse oxymetry, electrocardiogram (ECG), X-ray chest and echocardiography. Diagnosis was confirmed by echocardiography. Variables like gender, gestational age at birth, weight, family history, associated congenital malformations type of congenital heart defect were recorded and assessed using SPSS version 16.

Results

Out of the 5800 total neonates, 87 (1.5%) were diagnosed with congenital heart defect, thus showing an incidence of 15/1000 live births. There was a male preponderance 50(57.47%) versus 37(42.52%) female babies. Overall, 55 (63.21%) babies were <37weeks of gestation, while 32(36.78%) were more than 37 weeks at time of delivery. Forty (45.97%) were of <2.5kg weight, 35(40.22%) were between 2.5-4kg of weight, while 12(13.79%) were more than 4kg. Only 2(2.29%) neonates were found to have positive family history and 5(5.74%) had associated malformations (Table-1).

Of the total, cases, 27 (31.03%) had ventricular septal defect (VSD), 20 (22.9%) had atrial septal defect (ASD), 13(14.94%) had patent ductus arteriosus (PDA), 6(6.89%) had tetralogy of fallot (TOF), 4(4.59%) had transposition fo great arteries (TGA), 3(3.44%) had atrioventricular canal defect (AVSD) and 5(5.74%) had Pulmonary stenosis. One (1.14%) each was diagnosed to have aortic stenosis, single ventricle, Coarctation of aorta, peripheral pulmonary stenosis, pulmonary atresia, tricuspid atresia, complex CHD and 2(2.29%) had total anomalous pulmonary venous drainage (TAPVD). (Table-2).

Besides, 66 (75.88%) newborn were suffering from acyanotic, while 21(24.13%) had a cyanotic congenital heart condition (Table-3).

Further distribution of CHD into simple and complex

Table-1: CHD parametres.

Parametres		Number	Percentage
Acyanotic CHD		66	75.88%
Cyanotic CHD		21	24.13%
Gender	Male	50	57.47%
	Female	37	42.52%
Gestational age	<37week	55	63.21%
	>37 week	32	36.78%
Weight	<2.5 kgs	40	45.97%
	2.5-4kg	35	40.22%
	>4kgs	12	13.79%
Family history		02	2.29%
Associated malformations		5	5.74%

CHD: Congenital heart disease.

Table-2: Distribution of CHD.

Congenital Heart Disease	Number	Percentage
Ventricular septal defect	27	31.03%
Atrial septal defect	20	22.9%
Patent ductus arteriosus	13	14.94%
Tetralogy of Fallot	06	6.89%
Transposition of great arteries	04	4.59%
Atrioventricular canal defect	03	3.44%
Pulmonary stenosis	05	5.74%
Aortic stenosis	01	1.14%
Single ventricle	01	1.14%
Coarctation of Aorta	01	1.14%
Peripheral pulmonary stenosis	01	1.14%
Total anomalous pulmonary venous drainage	02	2.29%
Pulmonary atresia	01	1.14%
Tricuspid atresia	01	1.14%
Complex congenital heart disease	01	1.14%

CHD: Congenital heart disease.

Table-3: Distribution of CHD in acyanotic and cyanotic lesions.

	Type of CHD	Number	Percentage of Total CHD
Simple Acyanotic	ASD	20	22.98
	VSD(small)	5	5.74
	PDA(small)	4	4.59
	Peripheral pulmonary stenosis	1	1.14
Complex Acynotic	VSD(large and medium)	22	25.28
	PDA	9	10.34
	AV CANAL defect	3	3.44
	Aortic stenosis	1	1.14
	Coarctation of aorta	1	1.14
Cyanotic CHD	TOF	6	6.89
	TGA	4	4.59
	TAPVD	2	2.29
	Pulmonary atresia	1	1.14
	Tricuspid atresia	1	1.14
	Single ventricle	1	1.14
	Complex CHD	1	1.14
	Pulmonary stenosis	5	5.74

ASD: Atrial Septal Defect. VSD: Ventricular Septal Defect. PDA: Patent Ductus Arteriosus. AV: Atrioventricular. TOF: Tetralogy of Fallot. TGA: Transposition fo Great Arteris. TAPVD: Total Anomalous Pulmonary Venous Drainage. CHD: Congenital Heart Disease.

Table-4: Distribution of CHD in preterm neonates.

CHD Type	Number	Percentage of Same Defect	Percentage of Total CHD
VSD	19	70.37	21.83
ASD	13	65	14.95
PDA	9	69.23	10.34
TOF	2	33.33	2.29
TGA	3	75	3.44
Pulmonary Stenosis	3	60	3.44
AV Canal Defect	2	66.66	2.29
Peripheral Pulmonary Stenosis	1	100	1.149
TAPVD	1	50	1.149
Pulmonary Atresia	1	100	1.149
Single Ventricle	1	100	1.149

ASD: Atrial Septal Defect. VSD: Ventricular Septal Defect. PDA: Patent Ductus Arteriosus. AV: Atrioventricular. TOF: Tetralogy of Fallot. TGA: Transposition fo Great Arteris. TAPVD: Total Anomalous Pulmonary Venous Drainage. CHD: Congenital Heart Disease.

Table-5: Distribution of CHD in term neonates.

CHD	Number	Percentage of Same Defect	Percentage of Total CHD
VSD	8	29.62	9.19
ASD	7	35	8.04
PDA	4	30.76	4.59
TOF	4	66.66	4.59
TGA	1	25	1.149
AV Canal Defect	1	33.33	1.149
Pulmonary Stenosis	2	40	2.29
Total Anamolous Venous Drainage	1	50	1.149
Aortic Stenosis	1	100	1.149
Coarctation of Aorta	1	100	1.149
Tricuspid Atresia	1	100	1.149
Complex Congenital Heart Disease	1	100	1.149

ASD: Atrial Septal Defect. VSD: Ventricular Septal Defect. PDA: Patent Ductus Arteriosus. AV: Atrioventricular. TOF: Tetralogy of Fallot. TGA: Transposition fo Great Arteris. TAPVD: Total Anomalous Pulmonary Venous Drainage. CHD: Congenital Heart Disease.

lesions revealed that different simple acyanotic lesions contribution was as VSD (small) 5 (5.74%), PDA (small) 4(4.59%), Peripheral pulmonary stenosis 1 (1.14%) and ASD 20 (2.3%). Rest of the acyanotic lesions were complex acyanotic.

In pre-term neonates, total CHD cases were 55 (63.21%). Commonest lesion was VSD followed by ASD, PDA, TOF, TGA, Pulmonary stenosis and AVCD (Table-4). Total cases of CHD in full-term neonates were 32 (36.78%) Again, the commonest lesion was VSD (Table-5).

Discussion

CHD accounts for significant mortality and morbidity in neonatal period and later on all over the world. However, reported incidence in literature varies in different countries, racial and ethnic groups. There are multiple factors for this variation, including lack of technical facilities and necessary skills. As a result, many defects remain undetected.[6] Such difficulties in identification of CHD have been described in detail by Hoffman et al.[9] This study was conducted to estimate the incidence of CHD in a tertiary care neonatal unit in Rawalpindi, Pakistan. Neonatal unit is considered the best place for screening and diagnosis of CHD as highlighted by MaCabe.[10] Detailed clinical examination and pulse oxymetry can detect most of the cases,[11] but where available echocardiography combined with the above two is a better option.[1]

Our study reported an incidence of 15/1000 live births which is quite high when compared to 6.7/1000 shown by Yang,[1] 4/1000 live births in a review of different studies by Ferenez et al,[12] and 8.6/1000 live births by Nikyar.[8] It may be due to differences in size and nature of sample, place of study and methods employed to detect CHD. However, the incidence is even higher as reported by Fatema[6] i.e. 25/1000 in Bangladesh. It may be due to a common factor that both studies were conducted in a tertiary care setup. Our high reported incidence may be due to the reason that our unit is a tertiary care unit and a referral hospital. Moreover, we had a screening programme for all high-risk cases like positive family history for CHD, associated congenital malformations, history of drug intake and mothers suffering from diabetes mellitus and systemic lupus erythematosus (SLE). Many lesions likely to be closed in the first week of life were also picked up in this study, thus giving a high incidence. In addition to genetic factors affecting CHD incidence, racial differences and environmental factors like nutritional status may also be the reason for differences in incidence. A trained paediatrician/neonatologist in our study examined all cases within the first 24 hours of life so that even asymptomatic cases of CHD could also be picked up. Most of the neonates with critical CHD who are otherwise likely to die before coming to hospital were also diagnosed in our study.

We documented a male preponderance which is consistent with Farooqui[4] i.e. 61.72% to 42.52% (male 100 and female 62),[4] and Nikyar.[8] However, it is in contrast with studies conducted in Saudi Arabia[13] and Iceland[14] where they showed equal incidence in males and females. Our result is entirely opposite to a study conducted in Nigeria[15] where female patients outnumbered the males. These differences can be explained on the basis of ethnic and racial factors. Reller[7] also has shown association of certain CHD lesions with gender of neonate.

Regarding gestational age, we found CHD more common in pre-term neonates. It is in contrast with the results of a study conducted by Fatema[6] which shows 44.36% babies having gestational age <37 and 55.63% >37 weeks. We report that CHD is less common in low birth weight babies, while Fatema[6] reported that 89% were <2.5kg of weight. We do not find any plausible explanation for this difference. However, it can be explained on the basis as Reller[7] has suggested that CHD may impair the growth of the foetus.

As documented by Farooqui[4] Jackson[16] and Rahim,[17] we also found a greater incidence of acyanotic lesions. We report that amongst the acyanotic lesions, VSD was the most common which is consistent with findings of Rehan,[18] and Faud.[19] In contrast to our study Nikyar,[8] Fatema[6] and Rahim[20] found that ASD was the most common acyanotic CHD.

We found that TOF was the commonest cyanotic lesion as also shown by Rehan.[18] and Faud.[19] Farooqui[4] had reported that TGA was the most common cyanotic heart defect. The only explanation for this may be that our study duration was three years compared to 11 months of Farooqui.[4] In our study only a few of the cases compared to 18.30% shown by Fatema[6] who had other associated congenital lesions. The significance of family history as etiological factor was comparable to the results (0.91%) demonstrated by fatema.[6]

Autopsies due to social and religious factors were not performed on cases of unexplained neonatal deaths and that was a limitation in our study due to which we may have missed some cases of CHD leading to unexplained deaths. Our study had some other limitations also, like) it is a tertiary care neonatal unit data and not a community data. This means there can be a selection bias. Besides, only live births >28 weeks of gestation were included and still births were excluded. And, finally, we did not follow up the neonates.

Conclusion

CHD is a common congenital disorder of the neonatal population. Early diagnosis and timely management are key factors for optimal outcome of this problem. It can be easily diagnosed by detailed and careful clinical examination by trained medical personnel, pulse oxymetry and echocardiography. Exercising high index of suspicion during the neonatal examination can significantly change the outcome of CHD. We recommend a comprehensive neonatal examination at frequent intervals by trained professionals. The need of the hour is to equip neonatal facilities with pulse oxymetres and echocardiography machines.

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